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Contents.

	PAGE
Forthcoming Events	173
The Foundry Exhibition and Convention	173
I.B.F. President to Visit U.S.A.	173
Castings for Internal Combustion Engines	174
British Chemical Standard Steel "U"	176
Foundry Queries	176
New Works of Messrs. Thomas L. Hale, Ltd., Tipton	177
Duris Rain Water Pipe	179
British Industries Fair	180
Book Reviews	181
The Early History of Iron, with Special Reference to Cast-Iron	182
Heat Treatment of Non-Ferrous Alloys	183
Malleable Ironfounders' Association	184
Correspondence	185
Improvement in Moulding Box Appliances	185
Trade Talk	186
Iron and Steel Markets	187
Company News	188
Deaths	188

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE
INSTITUTION OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION

Institution of British Foundrymen.

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Forthcoming Events.

Institution of British Foundrymen.

Glasgow Section.—"Cast Iron and its Constituents," by — Turner, on March 26.

Falkirk Section.—"The Smelting of Pig-iron," by Alex. Anderson, on March 18.

Birmingham Branch.—"Improvements in the Annealing of Malleable Castings," by E. Miller, on March 11.

West of Scotland Iron and Steel Institute.—"The Work of Sorby and the Development of Metallography," by Professor C. H. Desch, on March 17.
—Annual general meeting, on April 27.

The Foundry Exhibition and Convention.

The Foundry Exhibition, which is to be held from June 15 to 24, is now in active preparation. Committees and sub-committees are now working out details for the competitions, the model foundry, historical exhibits, cinematograph shows and lectures on foundry subjects, which will be additional to those presented to the annual convention of the Institution of British Foundrymen. This convention, it will be remembered, takes place from June 21 to 23. Other technical societies also propose using Birmingham as a convention centre during the Exhibition period.

As was announced in our issue of February 23, the Duke of York will visit the Exhibition on June 20. Additionally, the Birmingham civic authorities are doing everything possible to assist the social side of the work.

The details of the competitions are nearly completed, and will embrace core-making, moulding and pattern-making. The first two will be held in the Exhibition itself, but the third will be carried out in the competitor's employer's works. Three classes of core-making will be included—heavy, light and medium, with two types to choose from in each class. Similarly three classes will be available for the moulding competition. Diplomas and substantial prizes are to be awarded.

From the details which are already available British foundrymen can congratulate themselves that they are to have this summer a convention which will materially differ from anything that has ever been attempted in this country in the past. The ground work has now been admirably laid, and obviously the success depends upon the support given to it by foundrymen in the widest sense of the word. So much is being arranged for their social welfare and instruction that a three-day conference scarcely seems an adequate period. The Americans allow five days in which to get through their business. We are well aware that they have no branch meetings as here, but it should be remembered that Americans "hustle," and every minute of their time is filled. Another factor is that the Duke of York's visit is dated for the day before the convention starts; we would suggest that even if it is found impossible to extend the duration of the convention it should at least be timed to start a day earlier.

Having some knowledge of the careful arrangements which are being made by an enthusiastic committee, we are convinced that the convention and exhibition will prove to be a renaissance of the foundry industry. There is at the moment exhibited by foundrymen a desire for knowledge, such as never previously obtained, and technically-trained travellers are being so cross-examined by buyers, managers and foremen that they complain of their inability to cover their ground at anything like their pre-war speed.

I.B.F. President to visit U.S.A.

Mr. Oliver Stubbs, the President of the Institution of British Foundrymen, together with Mr. T. H. Firth, past-President, is leaving for the United States by s.s. "Scythia" on April 8, and returns from New York on May 17 by the s.s. "Carmania."

Both gentlemen have been honoured by an unanimous invitation to be the guests of the American Foundrymen's Association on the occasion of their convention to be held at Rochester next June, but have reluctantly had to decline owing to the clashing of dates with the I.B.F. Birmingham Convention.

XUM

Castings for Internal Combustion Engines.

By Ben Shaw and James Edgar.

SMALLER CASTINGS.

Many of these castings are very simple and do not give either pattern-shop or foundry much concern. The carburetter, however, although the coring is intricate and requires considerable skill does not present any constructional difficulties to the pattern-maker, and thus, while great accuracy is called for in its manufacture, it appears wiser to make a composite article of a few castings, each of which has a distinct peculiarity, and which together comprise most of the pitfalls likely to be

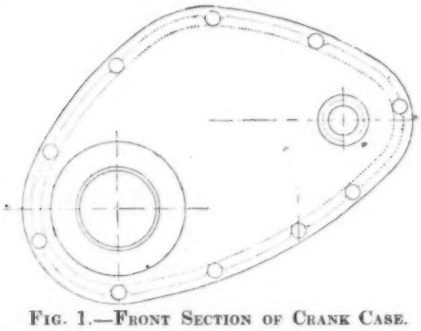


Fig. 1.—Front Section of Crank Case.

encountered in making the smaller petrol-engine castings.

It is not suggested that any of the castings shown in the accompanying diagrams are involved or exceptionally difficult. Indeed, to the expert who has specialised in this class of work they are distinctly easy, and do not present the constructional problems that a cylinder or crankcase present. With this, as with other work, confidence is an important virtue, and it should be remembered also that the method of making a crank-case bottom-

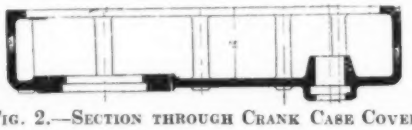


Fig. 2.—Section through Crank Case Cover.

half, for instance, may be admirable for one type but quite unsuitable for another type. Thus the craftsman must adapt himself to varying conditions and different designs. A description of a specific job is chiefly valuable as a concrete exposition of principles which may be applied to work of a similar kind.

For small work such as pistons hardwood should be invariably used; baywood is the best timber for all classes of pattern-making, but the question of cost sometimes debars the use of it for larger

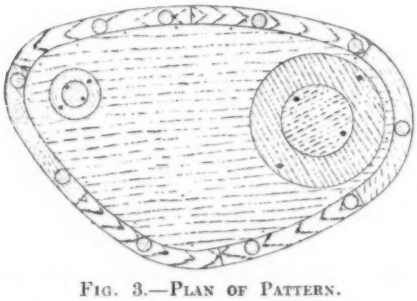


Fig. 3.—Plan of Pattern.

castings. If pine is used, as with the larger work, it should be free from knots, straight-grained and well-seasoned. With regard to filleting, dowelling, and feather-edges, what was said in the first article applies equally to small work. Wood dowels are not recommended, feather edges are invariably bad, and leather fillets are as satisfactory as fillets cut from the solid if they are well worked in.

Figs. 1 and 2 show the front cover of the crank-case described in a previous article. It will be observed that there is an internal flange. It is, of course, an aluminium casting. If such a casting was wanted quickly—a one off job—there would be no question of moulding it on a machine. The pattern would be glued up in two thicknesses, and the corebox would probably be made of a bottom-plate on which one thickness blocks would be screwed, the shape drawn and the block taken off and cut to shape. This would be very quickly done, and for an experimental job would be quite satisfactory. Something better is wanted, however, for quantity production, and Figs. 3 and 4 show a suitable pattern. The segmental method of construction lends itself to a shallow piece of work such as this. It might be built by other methods such as making a solid block and insetting cross battens to prevent it warping, but it is nearly always a

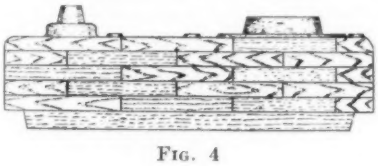


Fig. 4

disadvantage to have side- and end-grain on the same face, as is well known. The reason why segmental work sometimes gets irregular is because of carelessness in jointing or glueing, and frequently because the segments are made too long and the effect is the same as crossing timber. If segments are of a reasonable length, well jointed, and afterwards painted and varnished, the surface will remain smooth as long as the pattern holds together. It is not advisable to make the segments thicker than $\frac{3}{4}$ in. for a small job such as this, and $\frac{1}{2}$ in. is much more satisfactory. If the work is built longer than the finished size the band-saw and afterwards the sandpapering machine

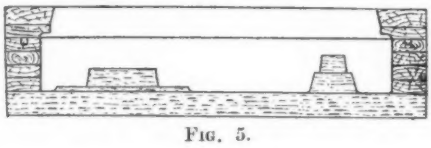


Fig. 5.

will quickly shape it. There is an unreasonable prejudice in some motor shops against the sander, but it certainly makes as satisfactory a finish as the hand tools. A slight taper should be left. From Fig. 4 it will be seen that the facings on top are turned. It is difficult to avoid feather-edges here, but they are not as objectionable when they can be glued down. In building the pattern no advantage would be gained by the segmental method if the top plate was carried to the outside size, and to obviate

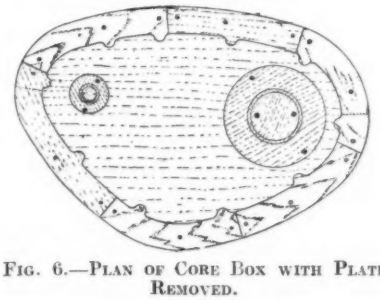


Fig. 6.—Plan of Core Box with Plate Removed.

this the top course of segments ought to be narrower than those beneath, thus forming a shelf on which the top plate can sit. The prints have a special taper, that is, the size across the top of the print may be $\frac{3}{8}$ in. less than the correct size of the core, and the corebox is made to suit. If the greatest care is not taken to ensure the pattern and corebox tapers being identical, the tapered print is a nuisance to the moulder, but it is an advantage, and saves any tampering with the mould to get the core set. The main print is shown

fastened to the pattern in Fig. 4 as a convenience. It would be taken off in the foundry when fitting the pattern on a plate.

It would be quite possible to make the large facing core a part of the main core, but very difficult in the case of the small boss-core, hence prints are shown in the corebox (Figs. 5 and 6) for both these cores. The segmental construction is as suitable for corebox as for pattern. The print portion of the box, because of the special taper and the internal flange, must be dowelled, and is thus shown made of two laminæ of segments, the fillet being carried from the bottom segment. A much more satisfactory result is obtained if the small bosses

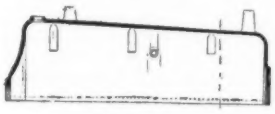


FIG. 7.

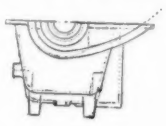


FIG. 8

round the corebox are not made separately because of the fillets. These should be well tapered to avoid trouble when the core is being delivered.

Fig. 6 shows a plan of the corebox with the top-plate removed. An altogether different form of construction from the foregoing has to be adopted for such a pattern as the crankcase bottom (Figs. 7, 8, 9 and 10). If it is a fairly large casting, say, for the cylinder described in the first article of the series, it should certainly be boxed up. If this method is adopted fairly thick timber ought to be used because of the large radius of the

This pattern will, of course, be moulded with the flange face-down in the mould, and the flange should be made in the form of a plate on which the body can rest. Because of the end facing being recessed it is advisable, as will be seen by referring to Fig. 13, which is a view of the finished pattern, to carry a plate across the end of the box. The facing can be left loose, as there is room for the moulder to draw it into the flange. The projecting portion of Fig. 10 can be screwed on as a separate piece, care being taken to leave the fillet that joins the body with a thick edge, which can

FIG. 9

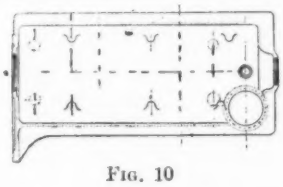
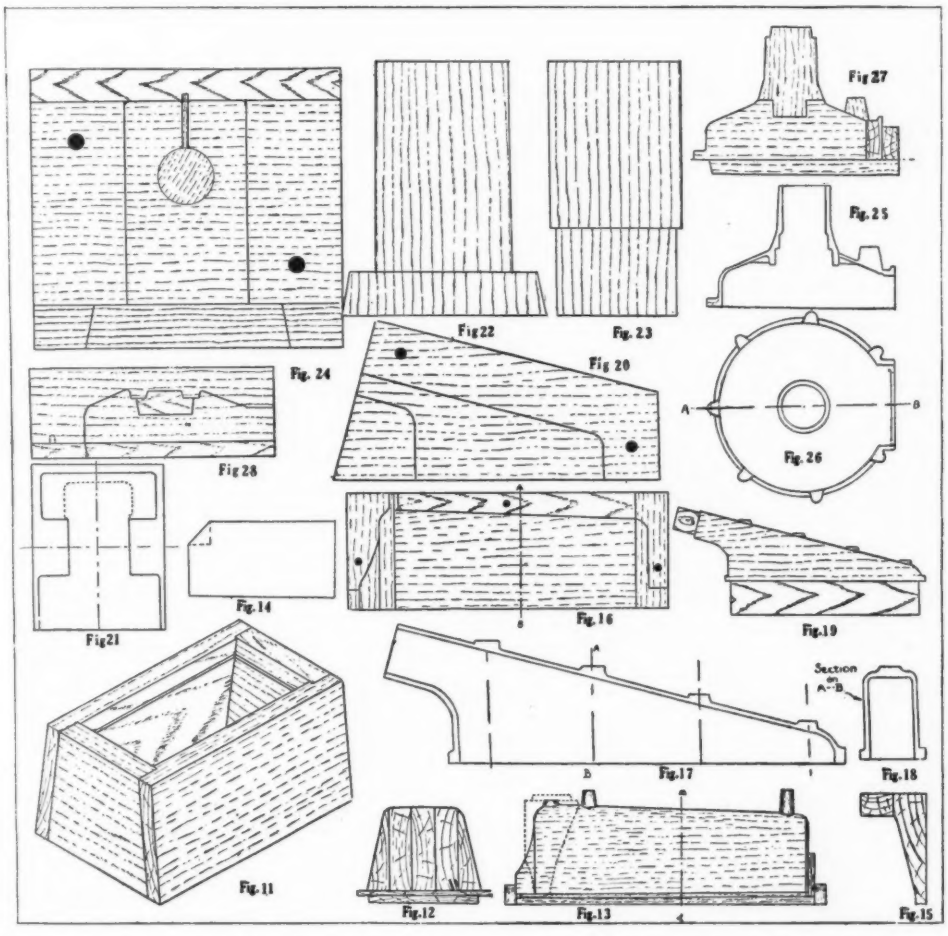


FIG. 10

be trimmed after the glue has set. The simplest way of coping with the circular branch at the corner on such a boxed-up pattern would be to glue blocks on the box and plane them off flush with the top and then finish the shape. In Fig. 13 this circular branch is shown dotted. It will be observed that end points are shown in addition to the face print, which need not be thick. Whether end prints are an advantage is a matter of opinion. Before leaving the pattern it may be profitable to discuss another method of construction, if the pattern is not too large. This method is illustrated



in Fig. 12, and consists of jointing 1¼ in. or 1½ in. together to receive the top. The style of jointing should be noted. The top rests on a cheek which is sawn from the sides and ends. The sides ought to be screwed into the ends and the screw holes plugged afterwards. To give the box additional strength cover-pieces may be glued inside. This is a good method of boxing-up many patterns which are square or rectangular, and from which many castings will be wanted.

in Fig. 12, and consists of jointing 1¼ in. or 1½ in. timber with the annular rings back to back. Such a pattern will never alter in shape. This method is occasionally adopted, and a certain portion of each piece is sawn away to reduce weight, but where it is necessary to do this it is certainly better and more economical practice to box-up.

The various small bosses on the pattern do not call for remark, and one good feature about the pattern from the moulder's point of view is that

XUM

it is well tapered. The boss shown at the side of Fig. 8 can be fitted with a long dovetail reaching to the top of the pattern, and will then cause no trouble to the moulder. The solid construction makes it possible to cut a diagonal at the corner, as shown at Fig. 14, for the circular branch. Better than a diagonal is to cut to the dotted line.

There are two ways of making the corebox for this pattern. One is to box it up so that the top of the box will be the print face, and the other to joint so that the box will be in two halves, the joint face being as shown in Fig. 16. The second method has advantages from the patternmaker's point of view. Figs. 15 and 16 make the construction fairly clear, Fig. 15 being a section of Fig. 16 on the line A B. The two halves are dowelled together, and consist of bottom plates on which blocks for the backs and ends are screwed. These are shown in the sketch as single thickness pieces, but for a large box they might have to be jointed of two thicknesses. The bottom fillet might be cut from the solid, as shown at Fig. 15, or leather fillets could be employed. The large circular core through the top facing could be made separately and set into a top print.

The water inlet is not as difficult as it is awkward. The body is rectangular, and the branch C is circular. It is much better to make the change from the body to the branch as a nice sweep rather than an abrupt shoulder, but the patternmaker must exercise some skill in getting the correct thickness of metal. This is a case where several templates can be used advantageously. The position which these fit should be carefully marked, and the lines transferred to the corebox, when suitable templates can again be used. In other types of water inlets which have separate openings supplying each cylinder jacket, a block print has to be used to balance the core. The pattern and corebox are jointed on the same line, a joint view of each being like Fig. 17. The entire pattern, except for the prints, can very conveniently be shaped from solid timber. There are no great moulding difficulties for the patternmaker to consider, but the large print should be fairly thick, although even this is not absolutely necessary as the core is not very heavy. Fig. 19 is a plan of the pattern, and Fig. 20 a joint view of the corebox, which does not require any jointing. Water inlets vary considerably in design, and are usually neat examples of patternmaking.

Pistons are more uniform in design than almost any other casting on petrol engines. As shown in Fig. 21, the metal is always thicker below the bosses because of the ring grooves. To the writers, there appears to be only one good method of making these pistons, and that is the method represented by Fig. 22. The small diameter of the print should be at least one inch longer than the diameter of the piston, and the taper may be 3/16 in. to ¼ in. all round. The print end is, of course, top in the mould, with the core resting on the ledge. The piston should have fair taper, and as it is machined this can easily be arranged for. Fig. 23 shows a method that is sometimes adopted for the piston pattern being jointed longitudinally. Not only is it less convenient for core setting, but a clean casting cannot be assured. When the piston is cast open end up a head of metal one or two inches long can be cast on, and a thoroughly sound casting results.

Fig. 24 is a joint view of the piston corebox, and scarcely requires any explanation. The bosses are fitted on the bottom of the box to avoid having loose pieces at the joint, and the ribs can be set into the end of the box and also the bottom. It is not bad practice to set such ribs into the boss as well, and they ought to be generously tapered.

It would be incorrect to suggest that Figs. 25 and 26 show a universal design of axle case, because this is a casting that varies considerably, but only in detail. We have seen some of these for heavy vehicles jointed on the line A B, and with several ribs to what may be termed the branches. The design is modified by the gearing. Some of the larger axle cases constitute quite intricate jobs. When the castings are made in halves jointed on A B, it is usually admissible to make the snugs or bosses so that they will deliver without having to be loosened. The small extra weight of metal does not, as a rule, matter. In the design with which we are dealing, however, it is not advisable to make a pattern in halves. Fig. 27 is a section of a suitable pattern, and as in the case of the piston a head can be left on the top of the boss. The body of the pattern can be turned and a piece afterwards sliced off and a flange C fitted. A small pattern may be turned from one piece of timber, but if large the timber should be jointed in a similar way to the crank case bottom. The boss can be fitted into the body with a turned dowel. The line A B is the actual mould joint line.

With regard to the corebox for the pattern, Fig. 28 is a section of a suitable box. This shows a print on the bottom of the branch core. It may be contended that the complete core should be made in one box. This is quite practicable, but the internal facing must in this case be left loose; for this reason it is better to make two separate cores. The box, like the pattern, can be turned, the part D being afterwards gouged through. It is necessary because of the taper on the print to make a loose top plate.

British Chemical Standard Steel "U."

The latest sample, which is now ready for issue, comprises a high carbon steel having a little nickel in it as an impurity.

It is of special use as (1) a standard for carbon by combustion or colour; (2) a low manganese standard associated with high carbon; (3) a low nickel standard.

The analyses have been undertaken as usual by a number of experienced chemists both in the United Kingdom, France, and U.S.A. representing the following interests:—British Government Department; U.S.A. Bureau of Standards; Referee Analysts—Independent; Railway Analysts—Representing users issuing specifications; Works Analysts—Representing makers and users.

The standard figures are as follows:—

Carbon Steel "U."

	Per cent.	Per cent.
Carbon (combustion) ...	(approx.)	1.203
Carbon (colorimetric) ...	1.18	
Silicon	0.18	
Sulphur evolved as sulphide	0.043	
Phosphorus	0.055	
Manganese		0.472
Copper	0.05	
Nickel		0.608
Chromium	0.03	
Vanadium	trace.	

The standard turnings may be obtained in 500, 100 or 50 gramme bottles either direct from Organising Headquarters, 3, Wilson Street, Middlesbrough, or through any of the leading laboratory furnishers at a price just sufficient to cover the cost. A certificate giving the names of the analysts co-operating, the types of methods used, and a detailed list of the results will be supplied with each bottle.

This sample completes a series of 14 steels containing increments of carbon between 0.03 per cent. and 1.20 per cent., also standardised quantities of the following elements:—Si, S, P, Mn, As, Ni, Cr, Co, V, W, Ti and Fe.

Foundry Queries.

Piston Rings.

D2.—We have found a mixture of 30 per cent. "Frodair Cylinder," 40 per cent. "Norrfield," and 30 per cent. good scrap to give very satisfactory results for such castings. Thorncliffe and scrap or Frodair and scrap would be considerably improved by the inclusion of some good hematite. "Inquirer" does not say what qualities he uses of the irons he mentions. This might further solve the matter.—"CYLINDER."

Thin Aluminium Castings.

E.22.—I should esteem it a favour if any of the readers of THE FOUNDRY TRADE JOURNAL would inform me what to do in a difficulty with aluminium in making castings varying in thickness from ¼ to 1½ in. in the thick parts. They come out very much pitted, which shows up when the skin is removed, and the surface has the appearance of being dusted with black sand.—T. D.

New Works of Messrs. Thomas L. Hale, Ltd., Tipton.

Incorporated in 1909, Messrs. Thomas L. Hale, Limited, laid down a foundry in Walsall, Staffs., for the manufacture of malleable-iron castings. This was at a period when there was a real demand for castings which, in addition to their malleability, would give a good wearing surface, and

FIG. 1.—VIEW IN FOUNDRY.

FIG. 2.—WOOD PATTERN SHOP.

the Company especially laid themselves out to meet this demand. As a result of lengthy experiments they evolved a special steel alloy which found immediate favour, and developments along these lines have been remarkably rapid, so that the ever-growing demand for the steel-alloy castings speedily taxed the Walsall foundry beyond its output capacity.

Rather than add to the existing plant to meet this demand, the Company decided to build an entirely new works in the layout of which they could turn to profitable account the experience gained at Walsall. The site of the new works is in Lower Church Lane, Dudley Port, in the centre of an important consuming district and about seven miles from Birmingham, with extensive sidings connecting with the L. & N.W.R. main line—Birmingham to Wolverhampton. The land acquired has an area of approximately ten acres, of which some eight acres are at present under cover, and the works find employment for 800 to 1,000 workpeople. A substantial suite of offices fronts on to Lower Church Lane, and, in addition to the usual staff accommodation, contains a drawing office and laboratory. From the offices the works are entered by way of a corridor, on one side of which is the pattern shop (100 ft. x 30 ft.), containing a variety of machinery for the production of wood and metal patterns. On the opposite side of the corridor are the pattern stores, comprising a roomy building (93 ft. by 68 ft. 6 in.), covered by three bays, with north lighting, in which the patterns are carried on numbered racks. The pattern record office is immediately at the entrance. Beyond the pattern stores is a spacious room (93 ft. by 25 ft. 6 in.) set apart for sorting and despatch, with exit directly on to the road. From this despatch room we pass by way of the rough stores (93 ft. by 24 ft.) directly into the foundry.

The foundry is covered by four bays, and the laboratory is so placed as to command a full view of the whole of the floor. The melting is carried out with modern appliances under scientific control. In all there are upwards of 60 various moulding machines, all of the Company's design and manufacture. A central portion of the foundry floor is set off for core-making and is served by four gas-fired core ovens.

Current is taken from the Midland Electric Power Company, at 7,500 volts A.C., and transformed to 440 volts A.C. for the works motors and 220 volts A.C. for the lighting circuit. The power plant consists of two 600 cub. ft. Robey compressors driven by a 50-h.p. motor, and two Alldays & Onions fans, each driven by an 18-h.p. motor.

Interesting work going through the foundry at

Fig. 3.—Metal Pattern Shop.

Fig. 4.—View in Dressing Shop.

For dressing the castings there are 12 double-headed grinding wheels and 6 tumbling barrels, each group being driven by a separate motor. For straightening the castings after dressing there are five presses, which are served by three gas-fired furnaces.

The annealing plant consists of 20 furnaces, arranged in five batteries of four each, the whole being gas-fired and having a total capacity of 300 tons of castings. The sand-blast plant, also designed by the Company, comprises four barrels, each fitted with blasting nozzles.

The power house occupies a building 50 ft. by 29 ft., part of it being set off as the sub-station.

the time of our representative's visit included a batch of ingot moulds, made of a patented alloy steel, and designed for service when casting non-ferrous metals. The affinity of copper and gun-metal mixtures to cast iron is well known, and after a limited service it is often difficult to get the ingot to leave such moulds; this means the moulds get hammered and consequently fractured. The special alloy, owing to its low phosphorus content, resists this affinity, and as the moulds are practically unbreakable they possess at least a three-fold useful life. A portion of the floor is also set apart for casting buffer caps and balls and "cylpebs" for grinding. The first,

manufactured under patent rights, are designed to prevent buffer locking of pit tubs and consequent stoppage of the road. The caps are made in various forms to take the place of the usual hoop, which, as every user knows, is a constant source of trouble owing to driving back or bursting. The caps are a completely manufac-

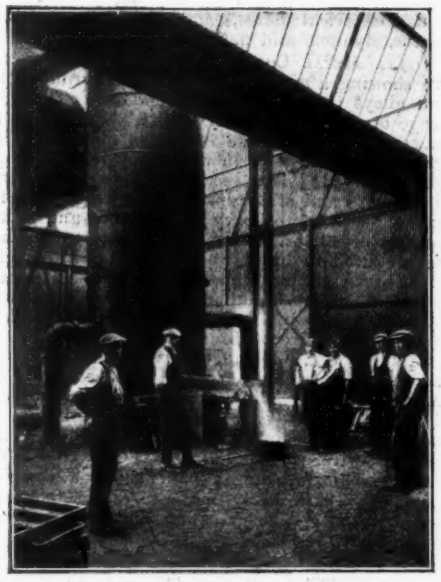


Fig. 5.—Tapping Side of Cupola.

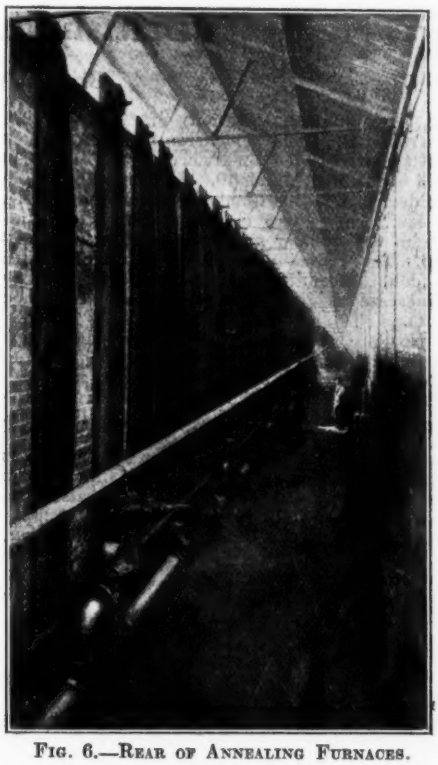


Fig. 6.—Rear of Annealing Furnaces.

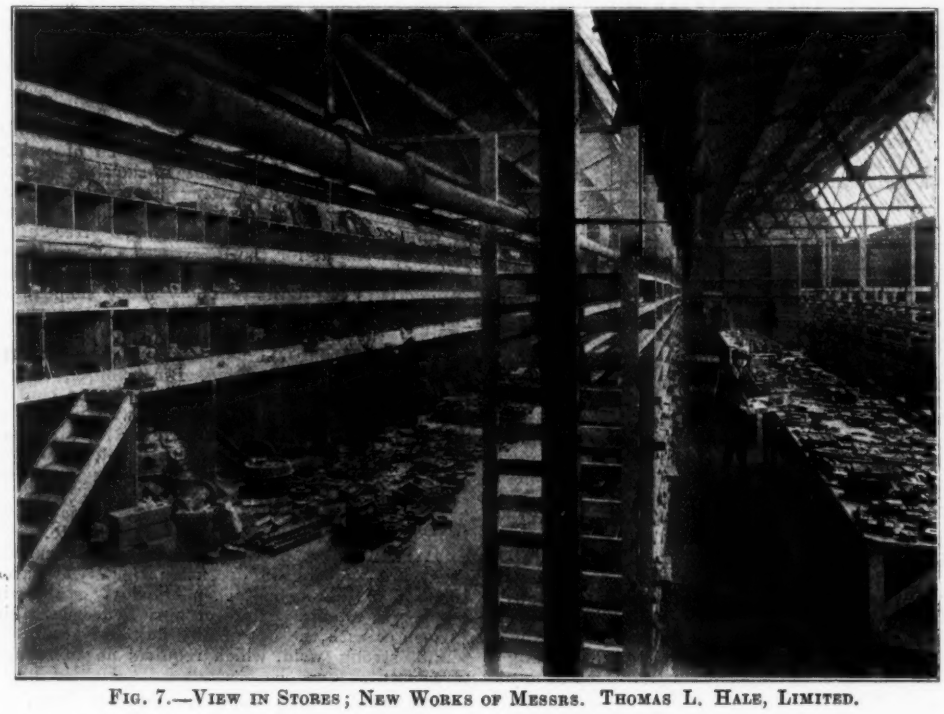


Fig. 7.—View in Stores; New Works of Messrs. Thomas L. Hale, Limited.

tured article, sent out with a special pin which acts as both bolt and rivet. The balls and "cylpebs" are a comparatively recent development, and are also manufactured under patents; they are made of a special alloy which on test has shown a remarkable resistance to wear. The balls have found a ready market and are now being turned out in large quantities.

Mr. G. S. Wilford, who for the past seventeen years has represented Cammell, Laird & Company, Limited, in the Midlands, has resigned his position with that company to join William McLean, Limited, iron, steel and alloy merchants, Stirling Chambers, Sheffield. Mr. Wilford becomes a director of Messrs. William McLean.

Duris Rain Water Pipe.

Mr. George West, of 19, Clare Road, Halifax, sends us particulars of a new type of fall pipe for which he has been granted Patent Number 33564, 1921. The invention consists of replacing the circular section by one which is roughly semi-circular, with the flat side replaced by two sides which form a right angle.

The object is to place the apex of the angle against the supporting wall, which allows of painting in a manner impossible with the ordinary pattern.

The Millom & Askam Hematite Iron Company, Limited, put a furnace into blast on Monday.

British Industries Fair.

Birmingham Section.

The Birmingham Section of the British Industries Fair, held concurrently with London and Glasgow, opened on February 27, and will remain open until March 10. Although there is a slight decrease in the number of stands compared with last year, there is a very substantial increase in the number and variety of articles displayed. The reduction in the number of stands is no doubt accounted for in a large measure by the increase in the number of the combined exhibits.

In previous Exhibitions held at Castle Bromwich there has been a weakness in the Engineering Section. The present Exhibition is in this respect a notable exception, as the Machinery Section, the machines for the most part being shown in actual operation, is a striking feature of the Fair.

The section devoted to non-ferrous metals is naturally dominated by the combined exhibit of the Brass and Copper Association, the Brass Wire Association, Cold Rolled Brass and Copper Association, Brazed Brass Tube Association, and the Nickel Silver Association, the five organisations representing upwards of 100 individual concerns. The combined exhibit of the Drop Forgers' Association is also very comprehensive and interesting.

The organisers of the Exhibition are to be congratulated upon the general arrangement. The careful grouping of exhibits according to the various trades will be found of very valuable assistance, alike to exhibitors and buyers. The official catalogue also calls for special mention. Catalogues of this nature too often closely resemble a Chinese puzzle. The catalogue in question, in English, French and Spanish with its valuable system of cross-indexing, is a masterly compilation, and at the same time refreshing in its simplicity. Exigences of space do not permit our giving a lengthy description. We, however, append brief particulars of some of the exhibits of interest to foundrymen.

Ajax-Wyatt Furnace Company, London, show the Ajax-Wyatt electric induction furnace for melting brass, gunmetal, nickel silver, bronze, etc. Sizes:—300-lb., 600-lb., and 1,000-lb.; Ajax-Northrup high-frequency induction furnace for melting gold and silver, and for research work such as melting *in vacuo*. Size:—40-lb. to 70-lb.

W. & T. Avery, Limited, Birmingham.—A most interesting exhibit is a platform weighing machine which has an automatic totaliser attached. One has only to step on the platform and the totaliser indicates the weight and records the number of weighings which pass over the machine; but it should, however, be understood that the machine exhibited is arranged in this way to illustrate how the totaliser works. It is sold fitted to pitbank weighing machines and other types, and its accuracy, speed, and the fact that it needs no weighman in attendance, are points of importance to the mining, blast-furnace, steelworks and similar industries. A No. 227 N. automatic pitbank weighing machine exhibited, which automatically indicates the net weight of contents of tubs as they leave the pitbank, has a removable casing to enable the working of the indicator to be seen. Another automatic machine is the dial weighing machine, in which the dial can be graduated in any national standard of weight. This machine contains no springs. A large range of platform scales are also exhibited as well as scales and balances for lighter trades. An interesting range of testing machines includes a spring-testing machine for laminated and coil springs. The laminated spring to be tested is placed upon trolleys upon the weighing platform, and the screw ram is brought down to bear upon it by means of an electric motor. The pressure upon the spring is recorded by the sliding poises upon the weighing steelyard, and the deflection of same is indicated by a pointer attached to the screw operating against a deflection scale. Coil springs are placed in the middle of the platform and are tested in the same manner. Avery's 50-ton universal testing machine for the purpose of applying tension, compression, bending, shearing and torsional tests is also shown, as well as Avery's balancing machine for crankshafts, armatures, rotors, etc.

Bengal Foundry Company, Limited, Tipton, Staffs., have an interesting assembly of iron castings, special die castings, melting pots, furnace pans, electrical boxes, manhole and inspection covers, dynamo and motor castings, etc.

Delta Metal Company, Limited, Birmingham, are showing a great variety of non-ferrous metals and alloys in which they specialise. The great range of specimens shown gives a good idea of the enormous scope of the extrusion process in the trades and industries in which non-ferrous metals are employed. The sections shown range from pinion wire and other small shapes weighing a few ounces per foot, to heavy angles, rods and special sections of 40 lbs. and more per foot run. These are produced in brass, yellow metal, white metal, naval brass, bronzes, copper, etc., either in special complicated shapes and forms, or as plain round, hexagon, square, flat and other rods and bars, in lengths as required. Brass and bronze pressings, stampings and forgings are shown in great variety; also castings, sheets and tubes, etc. The various "Delta" bronzes are shown in the form of rods and bars, shapes and sections, both solid and hollow; forgings, stampings, pressings and castings; wire, sheet, etc.

Frank Gilman, Birmingham, shows a complete range of "Skatoskalo" patent scaling tools, designed to meet every scaling and rust-removing requirement.

Godfrey Engineering Works, London, show the Godfrey oxygen jet cutting machine, an accurate machine tool that will cut with precision.

Gretna Engineering Company, Limited, Glasgow and Carlisle.—This exhibit consists of oil burners and oil-burning equipment, showing various applications to a boiler, both as an auxiliary to coal and for oil-firing entirely; also syrens, whistles, diaphones, gunmetal valves, cocks and special small fittings.

Hancock & Company (Engineers), Limited, Wallington, Surrey, give demonstrations of welding with town gas on various metals, showing fractures on the welds; coal-gas cutting plants, showing cutting on different thicknesses of metal with the new "Rapid" oxy-coal-gas cutter; free-cutting machine, shown for the first time, working on the principle of the wood fret-saw, but embodying cutting circles, straights and any fancy shapes; also "Hancock" high-temperature electric furnaces, working at temperatures up to 2,000 deg. C.

William Hunt & Sons, The Brades, Limited, Brade Steel Works, nr. Birmingham, show a complete range of tools for builders and contractors, railway companies and highway boards, including shovels, picks, trowels, etc.; for carpenters and joiners, including axes, chisels, etc.; for engineers and shipbuilders, including hammers, smiths' tools, snaps, punches, etc.

Silas Hyde, Birmingham, is showing japanning and enamelling stoves, shaking barrels, etc.

Hyde Welding Company, Limited, Wolverhampton, are showing in operation the Hyde patent method of joining metals, particularly steel, with copper in an atmosphere of pure hydrogen, which dispenses with the use of any flux and produces a clean, strong weld, which requires no subsequent treatment.

Thomas L. Hale, Limited, Dudley Port, exhibit various productions of malleable-iron castings, and in addition their patent ingot moulds and tub-buffer caps.

Industrial Research Laboratories, Gas Department, Council House, Birmingham, exhibit a collection of apparatus for the general testing of materials; examples of test-pieces and test report; various photo-micrographs of metals, alloys, welds and case-hardened samples; furnaces for general annealing operations, carburising, hardening, and tempering, and also special furnaces for work in the tool room.

Monometer Manufacturing Company (1918), Limited, London, W.C.2, are showing monometer patent melting furnaces, automatic heat controllers, patent die-casting machines, etc.

National Time Recorder Company, Limited, Birmingham, show automatic time recorders, in-

cluding ordinary patent check action, also recorders denoting automatically late arrival and overtime, together with automatic column adjusters.

PREMIER ELECTRIC WELDING COMPANY, LTD., LONDON, are showing a comprehensive exhibit of electric arc-welding apparatus, operated in accordance with patent design, whereby series resistances have been done away with. The plants embody a special form of reactance which materially assists the welder to maintain a steady arc. The fuel consumption of the sets has also been reduced to a minimum. The range of plants exhibited comprises the following:—*For Portable Work* (for welding with direct current): A self-contained engine-driven plant comprising a "Premier" welding generator, driven by a petrol engine, complete with switchgear, exciter, reactance, and all electrical fittings. *For Tramway and Similar Work* (for welding with direct current): A motor-generator plant which is a very compact unit comprising a "Premier" welding generator driven by a D.C. motor. The plant is totally enclosed in a sheet-steel housing, the instruments being fitted in the ends thereof, and is mounted on road wheels with swivelling axles and complete with pulling handle. *For Shop Work* (for welding with direct current): A belt-driven arc-welding set which should be of considerable interest to almost all engineering shops, being supplied as a complete unit ready for driving by belt from existing shafting, approximately 8 to 10 h.p. being required. This set is being shown for the first time, and has been placed on the market in order to put at the disposal of engineers a first-class arc-welding set at a minimum cost. *For Shop Work* (for welding with alternating current): An A.C. transformer plant which is particularly adapted for shop work in those cases where a supply of A.C. is available. Various types of electrodes are also exhibited. They are flux-coated and do not leave a layer of slag which requires chipping.

H. G. SLINGSBY, LONDON, show a selection of trucks, etc., including "Slingsby" sack, jackliftmaster, singlelift-elevating trucks; also electric elevating platform.

THOMAS SUMMERSON & SONS, LIMITED, DARLINGTON, are exhibiting specimen castings of a fine-grain, high-tensile cast iron under the trade name of "Granfin" Cast Iron. This material is a product of the electric furnace, and owing to its exceedingly fine grain gives tensile results and wearing qualities so materially superior to the best qualities of cast iron obtainable from the cupola as to make it worthy of the attention of engineers. The firm are also exhibiting patent laminated self-lubricating pinions, and samples are shown illustrating the construction, besides the finished article.

TANGYES, LIMITED, BIRMINGHAM, are exhibiting a heavy oil engine of the airless solid-fuel oil-injection type that will—in addition to the usual fuel oils—satisfactorily and economically work with the varying kinds of low-grade fuel oils that are from time to time being introduced on to the market. It is capable of starting from dead cold without the use of a heating lamp or electric ignition. The engine dispenses with the use of an external vaporiser and its consequent water drip. The combustion chamber is fitted with a patent hollow cover or sheath, which carries a spray-maker enabling low-grade heavy fuel oils containing a high percentage of asphaltum or bitumen to be satisfactorily used, without having to resort to cleaning of the combustion chamber or valves. The engine is fitted with a patent spray-maker by means of which the fuel oils are superheated before passing through the non-drip fuel nozzle into the combustion chamber. The governing is arranged by varying the quantity of fuel-oil injected through the spray-maker in proportion to the load on the engine, the fuel-oil being delivered by a pump operated by a cam on the sideshaft through a variable operating gear; this gear is operated by a sensitive governor of the spring-loaded revolving type; it varies the stroke of the fuel-oil pump, and therefore the amount of oil delivered through the spray-maker to the combustion chamber in proportion to the load on the engine. The firm are also exhibiting one of their latest gas engines working on suction gas supplied by suction gas producer. This engine works on the "four-stroke" cycle, the governing being effected on the "variable admission" system. The apparatus is complete with cooling and cleaning scrubber and also the usual expansion chamber. A hydraulic press for a working pressure of 2 tons per sq. in., and various examples of up-to-date steam pumps for boiler feeding and general pumping purposes, also a "quick-speed" vertical steam engine, are further features of this exhibit.

Book Reviews.

RESEARCH IN INDUSTRY, by A. P. M. Fleming, C.B.E., M.Sc., and J. G. Pearce, B.Sc. (Eng.). Published by Sir Isaac Pitman & Sons, Limited, Parker Street, Kingsway, London, W.C.2. Price 10s. 6d. net.

This treatise on research is particularly complete, as almost every aspect of the question is touched upon. It comprises nine chapters devoted to:—The basis of social progress; character of research; agencies for research; influence of character and conditions of industry upon research; co-operative industrial research; the works research organisation; design and equipment of research buildings; the co-ordination of research and the organisation of intelligence; the research worker; internationalisation of research. Additionally there is a very complete bibliography of the subject. The book is well illustrated with some thirty illustrations, and it is principally in this direction where the value of the book lies, as they would aid any firm which is considering the installation of a research department in the choice of design.

For the foundryman, the type of man who is to undertake his research is of extreme importance, and on this subject the views of the authors are, to say the least of it, curious. On page 29 they state "University staffs, as a rule, are more fitted for pure science research, as they have seldom had sufficient industrial experience to be intimately acquainted with industrial needs, and without this familiarity they would probably be led to engage in pseudo-research of little value." With this we are in total agreement, but on page 169 they say "The present method of training research men by associating them for a period after the graduation with the professor. . . has many advantages. . . . The plan is suitable for men entering any form of research institution . . . or works research organisation.

"It is *desirable*, however, that students entering industrial research should have an opportunity of *acquainting* themselves with the practice of the industry, with which they are to be associated. This may be done by entering a works, if no practical experience has been previously obtained, *for a period* of apprenticeship of about *two years'* duration designed to afford not skill in operations but a general knowledge of the organisation of and manufactures of the company." The italics are ours, and our reason for doing so is to emphasise the point that such a person is not worth the money of a skilled moulder and one to whom a chief chemist might entrust some routine testing under close supervision, but nothing more. Our conception for the research worker is a person who has academic, technical and practical experience, and who can surround himself by and direct a band of enthusiastic workers possessed of ordinary skill in their *metier*. The wish of the authors is, we gather from page 171, to keep all research work in the hands of University graduates, as, in their view, the laboratory boy only becomes a semi-trained, semi-educated scientific worker. It is common knowledge in the metallurgical industries, and probably the same state of affairs exists in other manufactures, that a fair proportion of the cleverest research workers started out in life as laboratory boys. According to the authors, the employment of other than University men may jeopardise the success of an expensive investigation by performing their testing in an emperical and rule-of-thumb manner. In our experience we have found that the academic man is far likelier to bungle a test than a chemical mechanic. Though we disagree with the authors on the general question of staffing, we congratulate them on having presented directors and managers with a book that will tell them exactly what a research laboratory is, how he can secure one for himself, and at what cost, and therein lies the utility of the book.

The Early History of Iron with Special Reference to Cast-Iron.

By J. Newton Friend, D.Sc., Ph.D., F.I.C. (Carnegie Gold Medallist).

Iron in Egypt and Palestine.

Iron appears to have been known in Egypt for many thousands of years. During blasting operations in the Great Pyramid at Gizeh in 1837, a wedge-shaped piece of iron was found in an inner joint, and, if coeval with the Pyramid, must be from 5,000 to 6,000 years old. It was examined by Flight, who concluded that it was not meteoric. Evidently, therefore, iron was worked even at that early date by the Egyptians. Gowland* suggests that it may possibly have come from the Sinaitic peninsular, having been obtained there by the accidental treatment of some iron ore—which occurs side by side with certain of the veins of copper ore. The search for iron amongst Egyptian relics of later periods has yielded disappointing results. Indeed, the metal does not seem to have found wide favour amongst ancient Egyptians. This is the more remarkable as the Assyrians, with whom they were in frequent communication, were very familiar with iron, as will present be shown. It is interesting to note that the earliest general group of tools found in Egypt was at Thebes, and dates back to 666 B.C.—the time of the Assyrian invasion. The modern Egyptian camel driver still wears iron rings, thus keeping up an interesting link with the past. As regards Palestine, it is generally conceded that iron was introduced 1200 B.C. by the Philistines,† who settled in Palestine about the same time as

FIG. 4.—A BRONZE AXE HEAD; NORTH IRELAND.

the Israelites, and who were a very cultured race. They were non-Semitic, possibly hailing from Crete. The constant petty skirmishes between the Israelites and the Philistines are readily understood when it is remembered that the latter possessed the fertile maritime plain whilst the Israelites occupied the relatively barren land above! Og, King of Bashan, about this time is reported‡ to have had an iron bedstead. No doubt the word bedstead would be more correctly rendered as "bier." In any case, that the dead king should be laid on a bier was quite a normal occurrence, and the fact that it is mentioned at all suggests that the unusual feature lay in its being made of iron.§

The oldest pieces of iron hitherto found in Palestine are two pieces found in the water passage at Gezer.‖ The curious part about this find lies in the fact that the passage had been sealed up prior to 1250 B.C., so that the pieces evidently date back to a time several hundred years anterior to that at which iron was in general use in Palestine. David was familiar with iron *circa* 1000 B.C., and the metal was evidently used at times for personal adornment, for a finger-bone with an iron ring corroded to it has been unearthed.¶ Certain iron knives found in tombs in Gezer are attributed to the Philistines,** and Goliath's spear is described†† as weighing 600 shekels of iron. In 2 Samuel xii. 31, the writer refers to "axes of iron" and "harrows of iron" in connection with David's victory over the people of Rabbah. The fact that iron is specifically mentioned suggests that implements of this kind were also made of bronze. David's son Solomon is stated (2 Chron. ii., 7) to have had iron workers of his own, although he found it necessary to send to Tyre for his chief artificer or foreman. Furnaces for the direct reduction of iron ore were well known to the later Hebrew writers,* and the ore appears to have come from Lebanon.†

According to an old Hebrew legend, the humanised god Tubal-cain‡ was "an instructor of every artificer in brass and iron." The word "Tubal" is probably Babylonian, and connected with *Gibil*, the god of solar fire. "Cain," which is missing in the Greek version, means "artificer," and was probably added as a suffix to Tubal to explain why he was regarded as the father or instructor of smiths.§ It is possible that in the earliest form of the legend Tubal taught men the art of getting fire. The legend resembles the Greek and Roman myths of Vulcan. The Canaanites had chariots studded with iron at the time of the invasion by the Israelites, and these are referred to, not only in Holy Writ,‖ but also in historical inscriptions in Egypt. They were probably of Hittite pattern.

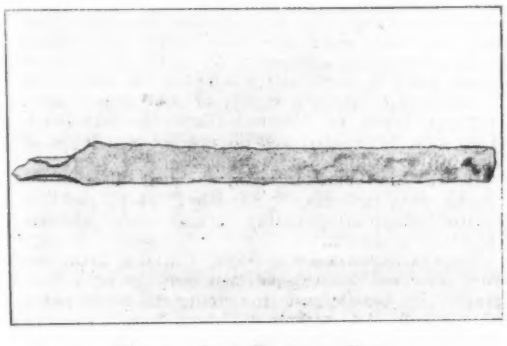


FIG. 5.—IRON CURRENCY BAR.

Found at Lyttleton. Length 12.72 ins., weight 1933 grains. From a drawing by Mr. W. J. Else, Curator, Worcester Museum.

Iron in Mesopotamia.

The earliest reference to iron in Assyria¶ dates back to 1400 B.C., where rings of iron covered with gold are referred to in the famous Tel-el-Amarna tablets. Ashur-natsir-pal, 885-860 B.C., states that in making an attack on Mt. Lara, in the fourth year of his reign, he cut a way for his troops with picks of bronze and *axes of iron!* The iron was obtained as tribute from various places, notably Carchemish, and later from Syria. King Sargon seems to have been the first to obtain iron from Armenia. The Assyrian King Rammannirari III., 810-782 B.C., is recorded as having received 3,000 talents of copper and 5,000 talents of iron as tribute from Aram Damascus.** In the ruins of the palace of Sargon II., 722-705 B.C., at Khorsabad, Victor Place discovered a storehouse containing an enormous quantity of iron, namely, about 350,000 lbs. This was mostly in the form of bars pierced with holes for convenience of transport. It was evidently a store of unworked metal ready to be made up into finished articles should the king require them. As Gowland†† remarks: "This vast accumulation of iron indicates incontestably that the metal had been in use for many centuries previous to the time of Sargon, so that it will not be unreasonable to assume that the Assyrians were acquainted with iron certainly earlier than 1500 or even 2000 B.C."

Iron in Europe.

Turning now to Europe, it appears that Greece was the first country to use iron, namely, about

* Gowland, *loc cit.*
† See 1 Sam., xiii., 19-22. Josh., xvii., 16-18 Judges i., 19; iv., 3.
‡ Deut. iii. 11.
§ See article "Bed." *Encyclopaedia Biblica* (Black, MCMI.), vol. 1.
‖ Macalister, *Palestine Exploration Fund, Quarterly Statement*, 1908, p. 1.
¶ Handcock, *Archeology of the Holy Land* (Unwin), p. 210.,
** Macalister, *Excavation of Gezer*, vol. 1, p. 299.
†† 1 Sam. xvii. 7.

* Jeremiah xl. 4; Deuteronomy iv. 20; Kings viii. 51.
† Deut. viii, 9. Jeremiah speaks of iron from the *north*, Chap. xv. 12.
‡ Genesis iv. 22.
§ See *Encyclopaedia Biblica* (Black, MCMI.), vol. 1, under "Cainites," sec. 10.
‖ Joshua XVII. 16, 18. Judges I. 19; IV. 3.
¶ Ridgeway, *loc. cit*, p. 615.
** *Encyclopaedia Biblica* (Black, MCMI.), Vol. 2. Article "Iron."
†† Gowland, *loc. cit.*

1400 B.C.* Homer (880 B.C.) was thoroughly familiar with the metal, and frequently alludes to it in both his Iliad and Odyssey, in which poems, however, he is describing a period anterior to his own, namely, about 1200 to 1400 B.C. The Trojan War was fought at the transition period in Greek history between bronze and iron. Hence it comes about that iron, gold and bronze are repeatedly mentioned amongst the treasures of the wealthy.† Thus Ulysses, in the guise of an old man, relates his experiences to the unsuspecting Gumæus, who has hospitably entertained him, and pretends to describe the wealth of Ulysses in far-off lands. He says:‡

"I saw myself the vast unnumbered store
Of *steel elaborate* and refulgent ore,
And brass high heaped amidst the regal dome;
Immense supplies for ages yet to come."

Although highly esteemed, iron was not regarded as precious in the sense of being a rare metal. It was evidently a well-known commercial commodity, used both like slaves and cattle for bartering, as well as for the manufacture of peaceful implements. Thus we are told that

"'From Lemnos Isle a num'rous fleet had come
Freighted with wine;"

and that the Greeks

"Hastened to purchase, some with brass, and some
With gleaming iron; other some with hides,
Cattle or slaves; and joyous waxed the feast."§

It is instructive to note that, with but two exceptions, Homeric weapons were of bronze, whilst the tools were of iron. One exception is the battleaxe of

"Great Areïthous, known from shore to shore
By the huge, knotted iron mace he bore."‖

Lang's explanation is undoubtedly the correct one, namely, that when iron was first manufactured its quality was uncertain, inasmuch as the necessary metallurgical skill to produce a reliable metal had not yet been attained. Hence it was not used for weapons where men's lives were at stake, except in solid lumps which could not easily bend or snap, as, for example, head of battle-axes,¶ for which keen cutting edges are not so necessary, the object being to give a hefty blow. Even in this case the axe is referred to as rather a curiosity. Strong, if indirect, support for the above view is afforded by the account given by Polybius** (205-123 B.C.) of the poor quality of the iron used by the Celts many hundred years later, namely, 223 B.C. The Romans inflicted a severe defeat upon them, and this is attributed to the fact that their long iron swords were "easily bent, and would give one downward cut with any effect, but that after this the edges got so turned and the blades so bent that unless they had time to straighten them with the foot against the ground they could not deliver a second blow."

If the iron at the disposal of the Homeric heroes was as uncertain as that mentioned above, it is no wonder that bronze was preferred for military purposes, since it would be giving an opponent somewhat of an advantage if a warrior had to halt on the battlefield and straighten his weapon.††

Even if Homeric iron was not as poor as that of the Celts, it is easy to understand that unless its quality was such as to render it very appreciably superior to bronze, the latter metal would be retained by military conservatism, "just as the Fifteenth Century soldiers found the long-bow and cross-bow much more effective than guns, or as the Duke of Wellington forbade the arming of all our men with rifles instead of muskets."‡‡

An interesting passage in the Odyssey shows that the Greeks, at the time to which we refer, had a certain knowledge of tempering. It is the account of the blinding of the gigantic Cyclops, by Ulysses, who plunged a fiery stake into his one and only eye. It runs:—§§

"As when the smith an hatchet or large axe
Temp'ring with skill, plunges the hissing blade
Deep in cold water (whence the strength of steel)
So hissed the blade around the olive wood."

The Romans were skilled metallurgists, and established arms factories all over their empire. At an early date they were familiar with steel and the method of tempering it. Thus Virgil,* writing about the year 30 B.C., his classical work, *The Æneid*, graphically describes the smithy in full work. He says:—

"A flood of molten silver, brass and gold,
And deadly steel in the large furnace rolled;
Of this, their artful hands a shield prepare,
Alone sufficient to sustain the war.
Seven orbs within a spacious round they close,
One stirs the fire, and one the bellows blows,
The hissing steel is in the smithy drowned."

Some years later Pliny, who was born in A.D. 43, collected together, in his famous *Natural History*, much that was known of iron and steel by the Romans in his day—no inconsiderable amount. After discussing the different ores of iron, and the method of tempering the carburised metal by plunging it into water, he makes (Book xxxiv., Chapter 41) the following interesting statement, to which I have never seen attention directed. He says:—†

"*It is a remarkable fact, that when the ore is fused, the metal becomes liquefied like water, and afterwards acquires a spongy, brittle texture.*"

This can surely only mean one thing, namely, that the Romans occasionally obtained, probably by the accidental overheating of their furnaces by extra draught, small quantities of cast-iron in their furnaces. This probably represents the earliest mention of cast iron in existence. The metal would be of no use to them as it was, not having furnaces capable of remelting it for casting purposes, so it would either be thrown away or more probably be mixed with subsequent charges and passed a second time into the furnace. Pliny also mentions that at the time of the Second Punic War (218-201 B.C.) "many personages who had even filled the praetorship, wore rings of iron to the end of their lives." Presumably the metal was held in such high esteem as to serve for personal adornment. Pliny goes on to say that even in his day slaves wore iron rings covered with gold. The right to wear pure gold rings was apparently never given to slaves.

(To be continued.)

Heat Treatment of Non-Ferrous Alloys.

Dr. D. Hanson, of the National Physical Laboratory, recently lectured on the subject of "Heat Treatment of Non-Ferrous Alloys" to the members of the Birmingham Metallurgical Society at the Chamber of Commerce, Mr. A. J. G. Smout presiding.

Dr. Hanson, whose lecture was illustrated with lantern slides, including many excellent micro-photographs, devoted most of his remarks to the consideration of the phenomenon of "age hardening" of certain alloys, notably duraliumin and the new Y alloy recently discovered and developed at the N.P.L. He reminded the audience, however, that "age hardening" was by no means restricted to aluminium alloys, but was found to occur in several directions and had many commercial applications. In the case of duralumin "age hardening" was found on close scientific investigation to be due to the difference in solubility of the magnesium silicide compound present in the alloy.

The chairman, Mr. A. J. G. Smout, in his remarks, said that Dr. Hanson had touched upon quite a new field of work, and one which undoubtedly possessed great commercial possibilities if exploited on scientific lines. He referred to several cases where non-ferrous alloys could be heat-treated advantageously.

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* Montelius, *J. Iron Steel Inst.*, 1900, II., 514.

† See *Iliad VI.*, 48; ix., 365, 366; x., 379, 133. *Odyssey* xiv., 324; xxi., 10.

‡ *Odyssey* xiv. Pope's translation

§ *Iliad.* Derby's translation, vii., 518-525.

‖ *Iliad* vii., 141. Pope's translation.

¶ See Lang. *The World of Homer*, Longmans, 1910. Chap. x.

** Quoted by Ridgeway, *The Early Age of Greece* (Cambridge Univ. Press, 1901).

†† Berard, *Les Phéniciens et l'Odyssée* (Paris, 1902). Lang, *Revue Archeologique*, 1906-7, 280.

‡‡ Lang, *loc cit.*

§§ *Odyssey*, Cowper's Translation, IX., 450-462.

* See Virgil's *Aeneid.* Translated by Dryden (Routledge, 1884), Book VIII. The italics are those of the present author. Virgil was born in 76 B.C., and was at work on the Aeneid when about forty years of age.

† Pliny, *Natural History.* Translated by Bostock and Riley (Bohn, 1857), Vol. VI.

Malleable Ironfounders' Association.

At the first annual banquet of the Malleable Ironfounders' Association, held at Birmingham on February 23, Mr. W. H. Proctor (Wycliffe Foundry Company, Limited) presiding. The Lord Mayor of Birmingham, Alderman David Davis, J.P., and Mr. J. P. Hannon, M.P., for the Moseley Division, attended as guests. Among the members present were Messrs. Charles Retallack (John Harper Company, Limited), W. Edgar Hale (Thomas L. Hale (Tipton), Limited), and F. J. Cook (Rudge Little, Limited).

The following telegram was sent to His Majesty the King:—"The Malleable Ironfounders' Association assembled at their annual banquet tender to your Majesty a respectful tribute of duty and loyalty, and offer heartfelt congratulations on the marriage of H.R.H. Princess Mary."

After the loyal toast was honoured Mr. J. P. Hannon, M.P., proposed "The malleable ironfounding industry," and emphasised the value of organisation as an essential means of advancing the interests of the industry, particularly where legislative measures were called for, and said from his Parliamentary experience, he could assure them it was useless to attempt to influence either Parliament or Government Departments, unless they were a powerful and united body, representing the whole of the trade. He strongly urged the necessity of lower taxation and cheaper postage.

Mr. Charles Retallack responding said he had never known a time when there was so much thought, anxiety and research put into the industry as at present. But he was convinced that the malleable ironfounders of Great Britain had determined not to rest, either in the matter of research, in the improvement of processes, or in the attainment of mechanical exactitude until they had reached even the highest records of the United States, and especially in the matter of the quality of the material. Some makers had already attained a very high level, almost claiming to defy competition. Some of them, however, were still struggling in the mire. There was a spirit, particularly connected with the British Cast-Iron Research Association, of high aspiration, which would be satisfied with nothing less than the best.

In that branch of their work they had pushed ahead, although they could still admire the marvellous production, reaching almost unlimited output, of America. He had just returned from his fourth visit to the States where he inspected 17 plants. At some places, he saw furnaces melting 60 tons and annealing 70 to 80 tons in an afternoon. It was astonishing to see the vast resources of the Northern Malleable Company whose returns were tabulated every day with the greatest precision, with ten chemists constantly at work.

He quite agreed with Mr. Hannon as to the necessity for federation. He was never afraid to introduce a stranger into the works. It was sometimes said to him, "Why do you bring competitors in to see all that you have been struggling, fighting and spending for all these years?"

The answer was very simple. He invariably gained more than he gave in any interview, and could always learn something. He was convinced that the true way to efficiency was frequent meetings. He was lately talking to an important trade union official who told him that between Birmingham and Wolverhampton there were 37 employers' associations, and the illustration used was that they were all working on branch lines and dealing with side issues, whereas if they all got together matters such as wages and remuneration could be dealt with together much more efficiently. He (the speaker) advocated a meeting of employers and employed to talk over processes, improvements, difficulties and successes as well as research. He had the good fortune to belong to the British Cast-Iron Research Association, and had been in communication with Mr. Cook and Mr. Fletcher and other gentlemen. The knowledge and intelligence that had been brought to bear on the business, day after day, meeting after meeting, was unparalleled and incalculable. After all, ironfounding was an abstruse subject, and one of the most difficult in all the industries of the country. But if they put their brains and experience together they were bound to succeed. By the combination of research, labour and capital, they would achieve the highest industrial results.

Presentations to Messrs. Proctor and Cook.

Mr. W. Edgar Hale made a double presentation of valuable silver ware to Mr. W. H. Proctor, the President, and Mr. E. J. Cook, the Secretary, for valuable services rendered. In Mr. Proctor they had a most capable and tactful president, and in Mr. Cook an untiring and energetic secretary. They were both men of mature commercial experience in whom they had the greatest confidence. He wished them to understand that their appreciation was far above the intrinsic value of the gifts which had been selected equally with a desire to give pleasure to Mrs. Proctor and Mrs. Cook. To their President, they were giving a silver fruit stand, and to Mr. Cook a pair of entrée dishes.

The health of the recipients was drunk with enthusiasm and musical honours.

Mr. Proctor, in acknowledging, said he greatly prized the heartiness of their tribute, and he felt it would have been impossible to serve the Association without the cordial support of the Secretary and the Council. Anything he could do on behalf of the Association would be gladly done.

Mr. F. J. Cook said that while his work had been a great pleasure the success they aimed at had not yet been achieved, though that was not due to the lack of interest or enthusiasm on the part of the Council who had never relaxed their efforts. They set out with high ideals to extend their business and improve the quality, thereby benefiting every member of the trade, but that could not be done unless the returns were sufficient to compensate their efforts. That adequate return had not yet been realised, and he attributed that to the fact that they were not strongly organised. It was very deplorable that they could get a higher price for grey cast-iron than for similar articles in malleable. While that continued it was impossible to give the quality essential to the prosperity of the industry. They had to meet home, Continental and American competition, and unless they could combine in such a way as to bring a proper return enabling them to produce castings equal in quality to their competitors they must go under. Their ideas were as far as possible from anything like profiteering, but they had not yet realised the success they looked for, though he was optimistic as to the future. The one essential to success was complete organisation. He was very grateful for the courtesy and co-operation he had received from everyone, and he was glad to take that opportunity of acknowledging the touching acts of kindness shown to him in his recent illness.

The Chairman took the opportunity in proposing the toast of "Our Guest," to refer to matters connected with the trade and Association. As they were fully aware, the Association had not been so successful as the Council had hoped, and that was mainly due to the poor attendances, which had been rather discouraging. They were engaged in one of the most difficult industries entailing possibly the greatest risk to the manufacturer, and it was not fair that their capital and brains should be expended without adequate return. Brains of the highest calibre had been employed, and their workmen possessed the highest possible intelligence and skill in the country; they were men of the highest possible knowledge and the finest character. Yet managers and workmen were inadequately rewarded, while most of the firms were actually losing money. The only remedy was organisation, and they had found it very difficult, in view of existing jealousies among competitors, to get the various members of the trade together. If they could succeed they would be able, not only to improve, but to cheapen the product, while they could get co-operative action in such matters as railway rates, the prices of coal and coke, unfair foreign competition and similar matters. However, he was very pleased with that meeting, and he had every confidence that eventually they would place their industry on a sound basis.

Referring to the zeal of the Lord Mayor in dealing with unemployment, the Chairman suggested that they should authorise the Council to make a donation to the Lord Mayor's Unemployment Fund.

The Lord Mayor, responding, spoke warmly as to the value of organisation and advocated the supplementing of State unemployment payments by municipal wages for which the unemployed workmen should give regular service in the general interest.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

The Solution Theory of Alloys, with Special Reference to Cast Iron.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Your issue of February 23 contains a very interesting Paper by Dr. F. J. Brislee on "The Solution Theory of Alloys, with Special Reference to Cast Iron."

Close analysis of the Section dealing with iron and carbon reveals some contradictory and confusing points, which require further elucidation. For comparative purposes I have divided these into two columns, with the heads under which they appeared in the Paper, as follows:—

A.—*Various Forms of Carbon in Cast-iron.* All fluid iron contains hardening carbon only; when it solidifies it produces graphite, then carbide, and, by long heating, temper carbon. If the iron containing the above varieties of carbon is melted, the solution of the constituents takes place in the reverse order.	A.—*How Constituents Separate when Cooling Cast-iron.* (1) The carbon in molten iron is in solution as carbide. (2) The system must be considered strictly to be one of iron-iron carbide. It is evident, therefore, that the molten metal which collects at the bottom of the blast-furnace consists of a saturated solution of iron carbide in iron. As the molten iron cools carbide is thrown out of solution, and, being unstable, it dissociates into iron and carbon with the separation of graphite.
B.—*Various Forms of Carbon in Cast-iron.* Carbon can exist in iron as carbide of iron, Fe_3C. The formation of carbide is favoured by slow cooling and hindered by rapid cooling.	B.—*Variables.* Slow cooling, on the other hand, will lead to the separation of carbon in the form of graphite, and may result in porous castings, especially when the graphite segregates in spots.
C.—*Various Forms of Carbon in Cast-iron.* Moissan prepared diamonds artificially by saturating molten iron at a high temperature with carbon and rapidly cooling the mass.	C.—*Variables.* If iron is saturated with carbon when molten and suddenly chilled, so that the carbide cannot dissociate into carbon, pearlite and hard castings may result owing to a high percentage of combined carbon.

As diamonds consist of pure carbon, the carbon in the iron, before quenching, must have existed as free carbon, and not carbide.

Yours, etc.,

A. POOLE.

626, Oakhill, Stoke-on-Trent,
February 27, 1922.

Keighley Laboratories Limited.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—The reply to my letter in your issue of February 16, *re* Keighley Laboratories, Limited, was both prompt and satisfactory, Mr. Poole, the managing director, at once according to me a cordial invitation, which I promptly accepted, and spent there an interesting and instructive afternoon.

I was agreeably surprised to see for myself the wide scope of their activities, and was impressed with their undoubted ability to be a real help to all iron founders who are progressive enough to make use of them.

It will be of interest to your readers to know—I have only just learned the fact—that any firm, whether a shareholder or not, can employ its services to the full and at the same flat rate of charges.

For many years the want of such an organisation as this has been felt, as few firms can afford such a plant for private use; and it behoves us all in these days of world-wide competition not to be content with the old rule-of-thumb methods, but to work on scientific lines now rendered possible by such institutions.

I learn that many firms after a trial run have been convinced of the benefits derived, and have been quick to fix up a contract for systematic analysis of purchased materials.

It will indeed be a happy day for iron founders generally when all materials used can be bought to specification within reasonable limits.

Yours, etc.,

S. L. BROWN.

Hunslet Foundry,
Moor Road, Leeds.

[It was pointed out in the article that shareholders and non-shareholders enjoy exactly the same conditions.—ED.]

Improvement in Moulding Box Appliances.*

The author points out that such improvements are made more slowly than in other parts of foundry equipment. Much work is still moulded in the floor, the size and singularity of shape of which (even where numbers are small) does not justify this. In his opinion box-moulding is quicker than floor-moulding in the ratio of 3: 2. The first error he cites is thick box corners, supposed to give rigidity. Only diagonal stays can give that, and the thickening causes piping and draw-holes in casting the box—hence the many box-corner breakages and cracks: cast-in stays increase this form of fracture. Many foundries plane the abutting edges of the boxes. The author regards this as expensive in time and labour, and inefficient. A filing-block of small length and about 0.1 in. proud of the box edges at each corner, with an additional one in the middle of each side for long boxes, is quite sufficient, takes only a few minutes to file, and can be tested against a flat plate to ensure that the box does not cockle. In this connection, however, the jig for boring the lug-holes must set the holes normal to the surface of these filing-blocks.

Closing and position pins are also discussed. All the common types of forged and turned pins (which are illustrated) are condemned as expensive to manufacture and liable to damage by rusting, bending, or breaking. The author recommends a conical-ended pin, made of bright drawn rod, for the following reasons: (1) less tendency to rust; (2) smaller variation, a boy will produce them on a lathe with sufficient accuracy; (3) one special machine only is needed for the tapers; (4) ample standard material for replacement; (5) the taper hole for the "firm" end of the pin admits of no play; (6) so long as it is normal to the filing-blocks it does not itself need to be bored in a flat or machined surface—as reduced butt-ended bolts do.

The author concludes with a table of a suitable range of sizes for boxes and pins to cover all ordinary small work, and he deplores the multiplication of intermediate sizes usually found.—T. EHRHARDT. ("Giess. Zeit." 18, 245-249.)

Lorraine Iron and Steel Industry.—During the last six or seven weeks, the iron and steel industry in Lorraine has been feeling the effects of the German railway strikes. The supply of German coke for the furnaces of the Moselle district ought to amount to 15,000 tons a day, whereas, during December, it varied between 8,000 and 10,000 tons. As a result, at the beginning of January only 17 blast furnaces out of a total of 66 could be kept going. The situation did not improve during January, when the daily deliveries averaged only 6,170 tons. If the recent strike had lasted longer it would have been necessary to requisition the stocks of coke of the mines in the occupied area in order to prevent all furnaces being damped down. This extreme measure has fortunately proved unnecessary, but for some time to come the blast furnaces of the Moselle district will still feel the effects of the disorganisation of the German railway services. It is announced that the consignments of coke are now being resumed, but that for some days they will remain at the rate of 5,000 tons for the whole of France, the Moselle district thus receiving an insignificant quantity. It is possible that the iron and steel works may again be obliged to buy a certain quantity of British coke. The iron-ore output in Lorraine in 1921 totalled 7,816,674 tons, as compared with 8,075,000 in 1920 and 21,133,676 in 1913.

* Institution of Civil Engineers Abstract.

Trade Talk.

The imports of foreign iron ore at the Senhouse dock, Maryport, last week amounted to 4,100 tons.

Marple & Gillott, Limited, Bank Street, Sheffield, have decided to reopen their Threlkeld lead mines, Penrith.

Mr. R. H. Ferguson, Continental iron and steel merchant, has removed to Bilbao House, New Broad Street, London, E.C.

F. C. Blackwell & Company, Limited, engineers, 57, Moorfields, Liverpool, are establishing another factory at Great Crosby, Liverpool.

The offices of Furness, Withy & Company, Limited, and associated companies are now situated at Furness House, Leadenhall Street, E.C.3.

The Atlas Steel Foundry & Engineering Company, Limited, and George Barnsley & Sons have joined the Federation of British Industries.

Reavell & Company, Limited, Ranelagh Works, Ipswich, have moved their London office to larger and more commodious premises at 47, Victoria Street, S.W.1.

M. H. Cawson & Company, metal merchants, formerly of 5, Salters' Hall Court, Cannon Street, London, E.C., have removed to 60, Gracechurch Street, London, E.C.3.

J. A. Prestwich & Company, Limited, motor engineers, have removed from Northumberland Park, London, N.17, to "Mohona," Church Lane, East Finchley, London, N.2.

An interesting paper on "Swedish Iron and Steel Manufacture" was recently read to members of the Sheffield Metallurgists and Metallurgical Chemists by Mr. H. L. Lockley.

The Tindall Drill and Engineering Company, Limited, 28, Spenser Street, Buckingham Gate, S.W.1, have removed to Sanctuary House, 33, Tothill Street, Westminster, S.W.1.

Owing to a strike of bricklayers at the Barrow Steel Works, who are asking to be put on the district rate and not on the sliding scale as hitherto, it has been necessary to close down the rail mill.

Mr. R. Greenwood, who is well-known in London foundry circles, has been appointed works' manager to the International Combustion Engineering Company, who are opening up a large foundry at Derby.

A paper was read to the Junior Institution of Engineers, North Eastern Section, in Newcastle recently, on "Drop Stamping and General Forge Work," by Messrs. E. F. Lough and R. N. Richardson.

Mr. P. E. Taylor lectured to the Yorkshire Association of the Institution of Civil Engineers, at Sheffield, on February 22, on "Relative Advantages of Reinforced Concrete and Steel for Constructional Purposes."

Mr. W. Welbury, ironfounder, late of Nook Foundry, Nook Street, Hillidge Road, Leeds, notifies that he has moved into more commodious premises on the site of the Old Leeds Pottery, in Leathley Road, Hunslet.

The City Accumulator Company, late of 75, Great Eastern Street, E.C., have acquired larger business premises at 79, Mark Lane, E.C.3, where they will continue their business as dealers in surplus stocks of electrical accessories.

Meldrums, Limited, Timperley, near Manchester, have taken orders for six refuse destructors, one being for a large shipyard (steam raising plant), and 15 installations of forced draught boiler furnaces, including one steel works.

The members of the West Yorkshire Metallurgical Society met on Saturday last, when a paper on "Surface and Internal Defects in Iron Castings, their Relationship, Cause and Prevention," was read by Mr. J. E. Fletcher.

The Rates Advisory Committee have issued the following further agreed amendments to Group 9:—Ore, purple: ore, purple, compressed into briquettes; and pyrites, iron, burnt (pyrites cinder), all in Class 1. Sulphur ore has been deleted.

The Minister of Transport has made an order authorising the Electrical Distribution of Yorkshire, Limited, to proceed with the supply of electricity in the districts of Selby, Stanley, Featherstone, Garforth, Horbury, Otley, Penistone and Rawdon.

The Eastern Export Company, Limited, 5, Lloyd's Avenue, London, E.C.3, intimate that they are receiving so many applications for the "Universal Standard Time Indicator" that they have arranged to mail specimens to any address at 2s. each, the proceeds being handed to the Royal Metal Trades Pensions Society, London.

A geared turbine vessel, "Diogenes," for the Aberdeen Line's passenger and cargo service between London and Australia, was launched at Queen's Island, Belfast, last week. The new ship has a tonnage of 12,300 and her dimensions are:—Length 500 ft., breadth 63 ft., depth 35.3 ft. She is the first vessel constructed at Harland and Wolff's new east yard.

The E.W Harvey Gas Furnace Company, Limited, of 70, Victoria Street, Westminster, have received, through their Glasgow representatives, Messrs. Gillespie Bros. & Company, an order for one of their regenerative-gas plate heating furnaces with a gas-producer, to be built for Messrs. Orr Watt & Company, Limited, at their Lanarkshire Bridge Works, Motherwell.

The South Yorkshire Steel Ingot Makers' Association had a conference at Sheffield on February 22, with representatives of the Amalgamated Engineering Union, the Blacksmiths' Union, and the Electrical Trades' Union, to discuss the question of the application of the steel ingot makers' sliding scale to the semi-skilled members of the unions without the consent of the unions concerned. The conference failed to reach an agreement.

Messrs. Alfred Danks, Limited, engineers, of the Westgate Iron Works, who also own the business of J. M. Butt & Company, at the Kingsholm Foundry, are concentrating the whole of their business departments at the Emlyn Works, Gloucester, for many years occupied for general engineering purposes, by Mr. C. D. Phillips, and later by the Avon Malleable Iron Foundry. The new works, which were recently entirely re modelled, are thoroughly up-to-date in every detail, and constitute one of the best equipped foundries in the country.

Samuel Denison & Son, Limited, of Leeds, have in progress a large set of locomotive wheel balancing tables, for erection in the workshops of the Nigerian Railway at Ebutte Metta. The machine consists of fourteen separate tables, each of 9 tons capacity, and each having its own indicator. When the locomotive is run on to the machine, each wheel is on a separate weighing machine, and adjustment to the engine springs is then made so as to distribute the weight as required. Similar machines have recently been supplied to the Great Eastern Railway, and also the Mashonaland Railway.

A deputation from the Newcastle Chamber of Commerce, representing the retail iron trades of the district, waited upon Mr. C. A. Lambert, divisional goods-manager of the North-Eastern Railway Company, in regard to railway rates, which, it was asserted, were so high as seriously to hamper the retail iron business, and in respect of a regulation that unless notice of non-delivery of goods was given within fourteen days of the date of despatch, the Company could accept no responsibility in case of loss. There was discussion on these questions, which received sympathetic consideration by Mr. Lambert.

It appears that the New Zealand contract for about £100,000 worth of electrical plant, awarded recently to British firms, comprises the bulk of the plant required for the Mangehao power house, but does not cover all the machinery required. Details of the contract show that seven 4,000-kw. transformers are to be purchased from A. D. Riley & Company, Limited, at a cost of £16,574; three 6,450-h.p. and two 3,250-h.p. water wheels from Boving & Company, Limited, for £23,795, and three 6,000-kw. and two 3,000-kw. generators from the Metropolitan-Vickers Electrical Company, Limited, at a cost of £54,968. Among the tenderers were American and Swedish firms.

The attempt to settle the strike of bricklayers employed in steel forges in Warrington, Irlam, Ulverston, Millom, Workington, Darlington, and Askam has failed. The employers proposed, as a compromise, that the reduction of 11s. a week, which followed one of 15s. a week made three months ago, should be made by instalments, 4s. to come off immediately, another 4s. on March 12, and the remaining 3s. on April 9. This, the employers suggested, should remain in force until May 7—the date of the next ascertainment of the selling price of steel, on which the men's wages are based. It was expected that a further reduction of 20 per cent. would then be proposed. These terms have been refused.

At the annual meeting of the British Non-Ferrous Metals Research Association, held at Birmingham on March 3, Mr. T. Bolton, who presided, comprehensively surveyed the activities and progress of the Association, which has now over 100 member firms. A number of important investigations are being conducted by the Association in various laboratories. He emphasised the fact that division of labour is as important among brain workers as among hand workers, and co-operative research was the best and most economical method. He referred particularly to the proposal of the Association to establish University Fellowships for post-graduate research. Vice-Admiral Sir George Goodwin urged the Association to make its work more widely known, and stated that marine engineers and shipbuilders would be prepared to listen to proposals for membership if the Association's programme were put before them. The scientific metallurgist, the manufacturer, and the user should have their knowledge and experience combined for the benefit of themselves and the nation.

IRON AND STEEL MARKETS.

Pig-iron.

The more active conditions noted in the pig-iron trade last month have been succeeded, unfortunately, by a period of quieter business, and apart from the Tees-side centre, demand is again on a comparatively restricted scale. In the South Staffordshire area, especially, production of pig appears to be almost stationary, and in any event is now in excess of requirements, the prevailing stagnation in the rolling mill department having reduced consumption of forge iron to an appreciable extent. There are, however, a few fairly good-sized orders for cast-iron pipes in hand in the Midlands, but generally the foundry demand is on a limited scale. Nor are the Scottish smelters any better off, the increasing scarcity of orders for pig-iron leading to keen competition for any business offering in the market. Some export business has, however, been done, 395 tons of pig-iron having been shipped from Glasgow last week. At Middlesbrough demand has been checked by the threatened stoppage of the electrical industry, and buying has been considerably reduced on home account. On the other hand, export business during the month just closed has been well maintained, the shipments of pig-iron from the Port of Middlesbrough during February amounting to 32,239 tons, of which 6,895 tons went coastwise, and 25,434 tons abroad, as compared with 31,265 tons in January, an increase of 1,064 tons. To the February total, however, must be added, as in pre-war times, 3,030 tons shipped direct from Skinningrove on the Cleveland coast, to Grangemouth. Both for home consumption and for export a uniform price is quoted, No. 1 Cleveland and silicious iron being at 95s. per ton, No. 3 Cleveland G.M.B., 90s.; No. 4 foundry, 87s. 6d.; No. 4 forge, 82s. 6d.; and mottled and white (about) 75s.

East Coast hematite is now quite scarce. Makers are so well sold that they are not pressing for business, and to inquirers generally they quote 100s. for mixed numbers and 101s. for No. 1. Possibly these prices might be shaded, but only slightly. In West Cumberland Bessemer mixed numbers are quoted at £4 18s. 6d. per ton at works, a figure that is unlikely to undergo any modification for some time to come.

Finished Iron.

The outlook in the various sections of the finished iron trade shows little improvement, the majority of the mills, forges and factories remaining wholly or only partially employed, while buying on forward account is practically suspended for the time being. The Birmingham market last week, though well attended, was certainly favoured with a fair volume of inquiries, but the resulting business was disappointing in the extreme, the few orders placed being almost solely confined to hand-to-mouth requirements of immediate urgency. Manufacturers, as a rule, insist that prices at present are quite unremunerative, and yet frequently lower quotations submitted are accepted in order, it is stated, to keep works going. Makers of marked bars are perhaps in a better position than those of other materials, production on a moderate scale being well maintained, with prices fairly steady. Any price-cutting practised applies more to the common bars, crown qualities having been offered at £11 10s. and even less, while nut and bolt iron has been quoted at £10 15s., with only a poor demand. Iron gas strip remains entirely off the market, a by no means surprising fact when it is remembered that steel strip for tube-making purposes is freely on offer at £11 10s. Scottish demand for finished iron does not show any improvement. The bar iron works are running about three, or, perhaps, four days per week, which is all that is required to clear off the week's commitments. Prices remain unchanged.

Steel.

The critical position in the engineering and electrical industries at the moment will, in all probability, account for the lull experienced in the steel markets, in which there is still a lack of forward buying needed to impart some stability to movements in that direction. At Sheffield there has been no striking change for the better of late; most of the firms, however, continuing to secure small orders, many of the electric steel furnaces managing to keep running. Demand for mining and drill steels for South Africa has, however, diminished owing to the Rand labour troubles, and business in ferro-alloys has in consequence fallen off to a considerable extent. Orders for railway material are also unaccountably withheld, notwithstanding that by this time reserves of rails, tyres, axles and springs must be practically exhausted, and local plants have been standing idle. Substantial buying in this direction cannot, however, be long delayed, and this should mean a period of brisk activity in the near future. Hopes are also entertained of an early resumption of Sheffield trade with South America, although it may be feared from recent reports that German steel manufacturers have largely supplanted British interests in that market.

Ore.

A temporary shortage of ore tonnage has driven up freights from the Mediterranean and Northern Spain. At the week-end the Bilbao freight was 8s. 3d., and at this figure it is doubtful if a seller of best rubio ore could be found at less than 27s. per ton. Consumers refuse to pay any such figure, and as freights are expected to fall again as more tonnage becomes available, business in foreign ore has almost ceased.

Scrap.

On the North-East Coast the demand for scrap is only on a limited scale, though there is certainly a slight improvement as compared with a week or two ago. The following are current prices: Heavy steel scrap, 60s per ton; heavy steel turnings, 42s. 6d.; cast-iron borings, 41s. to 42s. 6d.; bushelling scrap, 62s. 6d.; heavy forge-iron piling scrap, 65s. to 67s. 6d.; heavy machinery cast-iron scrap in handy pieces, 85s. to 87s. 6d.; ordinary heavy cast-iron in handy pieces, up to 80s. per ton. All delivered works.

Tinplates.

Some slight improvement in the tinplate market may be noted during the past week, and although very little fresh business has been coming along, the general tone has been distinctly steadier. The output, which has been reduced to approximately 50 per cent. of normal, is still above the present demand, but there is a feeling about that values have fallen to bed rock. I C 14 x 20, 112 sheets, 108 lbs. coke tins have been sold at 18s. 6d. per box, but, generally, quotations may be called 18s. 9d. to 19s. per box for spot delivery, and 18s. 6d. to 18s. 9d. for March-April.

Metals.

Copper.—Recently the market for standard copper has developed alternate weakness and strength, due to a preponderance of speculative dealings, but this week has opened with a steadier tone, with values showing a slight improvement. Demand on consumptive account, however, continues restricted, and until existing labour troubles are adjusted there is little prospect of expanded business. March dates have been done at £60 5s. to £60 7s. 6d.; May, £60 10s. to £61 7s. 6d.; and June at £61. Refined copper has been steady, with electrolytic advanced 10s. to unchanged at £65 to £66 10s. Closing prices:—Cash: Wednesday, £58 17s. 6d.; Thursday, £59; Friday, £59 5s.; Monday, £60; Tuesday, £60 2s. 6d. Three months: Wednesday, £59 17s. 6d.; Thursday, £59 17s. 6d.; Friday, £60 5s.; Monday, £60 17s. 6d.; Tuesday, £61 2s. 6d.

Tin.—Some slight improvement in the statistical position, as disclosed in last month's returns, had a favourable influence on the week's opening market for standard tin, and values showed a steadier tendency than of late. Consumptive demand is, however, still on a limited scale, the tinplate trade in South Wales being depressed, and business is consequently confined mainly to the supply of urgent requirements. There was a fair turnover in Monday's markets, with March sales reported at £145 to £145 15s.; April, £145 10s.; May, £147. English ingots also closed higher at £142. Stocks of tin in Metal Exchange warehouses at the end of February totalled at 6,778 tons compared with 6,847 tons at the close of the preceding month. Closing prices:—Cash: Wednesday, £141; Thursday, £141 15s.; Friday, £143 7s. 6d.; Monday, £144 15s.; Tuesday, £142. Three months: Wednesday, £143; Thursday, £143 15s.; Friday, £145 7s. 6d.; Monday, £145 17s. 6d.; Tuesday, £144.

Spelter.—Business in the market for this metal has been quietly firm, with the improvement in values recently noted well maintained. Some fairly good buying on American account is also reported. Closing prices:—Ordinary brands: Wednesday, £24 15s.; Thursday, £25 2s. 6d.; Friday, £25 7s. 6d.; Monday, £25 12s. 6d.; Tuesday, £25 12s. 6d.

Lead.—Movements in soft foreign pig this week have been without outstanding features, but the tone throughout has been consistently steady, with values firm showing a slight advance. English closing prices: Wednesday, £21 15s.; Thursday, £21 15s.; Friday, £22 5s.; Monday, £22 5s.; Tuesday, £22.

XUM

Company News.

Beyer, Peacock & Company, Limited. — Ordinary dividend, 5 per cent. per annum, less tax.

Scottish Tube Company, Limited.—Ordinary dividend, 7 per cent. per annum, less tax, for 1921.

North British Locomotive Company, Limited. — Ordinary dividend, 10 per cent., free of tax, for year.

W. D. Rees & Company, Limited.—Capital £10,000 in £1 shares. Colliery owners. Registered office: York Chambers, Swansea.

Wood & Martin, Limited. — Capital £7,000 in £1 shares. Coal and timber merchants. Registered office: 105, London Road, Leicester.

Matthew Wylie & Company, Limited. — Capital £50,000. Engineers, iron and brass founders, etc. Registered office: 81, Portman Street, Kinning Park, Glasgow.

W. H. Thomas & Sons (Birmingham), Limited.—Capital £1,000 in £1 shares. Brassfounders, ironfounders, and engineers, etc. Registered office: 74, Ford Street, Hockley, Birmingham.

Crippies, Limited.—Capital £100 in £1 shares. Ironfounders. Directors: J. L. Baynes, A. R. T. Perry, A. G. Beckett, and H. Crump. Secretary: A. J. Spiers, Registered office: 10, Hampton Street, Brighton.

Vulcan Pattern Making Company, Limited.—Capital £1,500 in £1 shares. Directors: W. G. Francis, A. Towle, and W. H. Cramp. Secretary and solicitor: J. Arch. Registered office: 132A, Much Park Street, Coventry.

Vickers, Limited.—Final dividends for half-year ended December 31, 1921: 2½ per cent. on preferred five per cent. stock, less tax; 2½ per cent. on five per cent. preference shares, less tax; 2½ per cent. on cumulative preference shares, free of tax.

J. L. Carty & Company, Limited.—Capital £10,000. Iron and steel founders, engineers and manufacturers of implements and machinery of all kinds, etc. Directors: R. D. Carty, J. McLuskie, and J. Rutherford. Registered office: 38, Oswald Street, Glasgow.

Deaths.

Mr. J. Edwards, joint managing director of Higson, Edwards & Company, Limited, the Liverpool firm of iron, steel and tinplate merchants, died recently. Mr. Edwards, who was in his 60th year, was formerly associated with Mr. G. L. Higson in the business of Shaw's Brow Iron Company.

Mr. E. W. Neems, who died on February 15, aged 66, was formerly connected for many years with Henry Rogers, Sons, & Company, Limited, metal merchants, etc., but subsequently established himself in business as a metal broker and merchant. At the time of his death he was head of the firm of E. W. Neems & Company, 11, Fenchurch Street, London, E.C.3.

Mr. W. Cowan, who, until succeeded by his son, Sir H. Cowan, M.P., four years ago, was chairman of Parkinson, and W. and B. Cowan, Limited, died recently. Mr. Cowan, who was in his 89th year, was formerly a well-known gas engineer, and was actively associated for many years, chiefly in Edinburgh, with several of his own inventions and improvements in gas meters and governors.

Mr. J. Marshall, head of the Gainsborough engineering firm of Marshall, Sons & Company, Limited, died at his residence, Spital Terrace, Gainsborough, on February 27, at the advanced age of 86 years. With his brother, the late Mr. Henry Marshall, who died in March, 1906, Mr. James Marshall built up the present works from a small engineering and millwright's business, which his father, the late Mr. William Marshall, of Manchester, purchased in Gainsborough in 1848. The business developed so rapidly that in 1862 it was formed into a private joint stock company, with Mr. Marshall and his brother as joint managing directors. With his brother, Mr. James Marshall established technical instruction in Gainsborough long before county councils came into existence, and erected and equipped a fine block of modern classrooms for the use of the several hundreds of students who avail themselves of the opportunity to study.

Portable Electric Tools. — Designed to illustrate the advantages in increased and more rapid production made possible by the use of portable electric tools, an exhibition of labour-saving appliances was recently organised by the General Electric Company, Limited, in their showrooms at Magnet House, Kingsway, London. Conspicuous among the exhibits, most of which could be seen at work, was a complete range of "Witton-Kramer" portable electric tools, manufactured at the Company's works at Witton.

MACHINERY. *See also page* 18.

FOR SALE.—Manning Standard Gauge SIDE TANK 0—6—0 LOCOMOTIVE, 14 in. x 20 in., date 1908, in working order; can be inspected at Garstang (near Preston).—Apply, Manager, Knott End Railway, Knott End, Lancs.

ALMOST new Carr's Patent Natural Draught Double CRUCIBLE FURNACE going cheap; also equipment of small foundry.—Mr. Wood, 86, Sandmere Road, Clapham, S.W.

SAND DISINTEGRATORS and SAND MIXERS. Special offer of several ex surplus stock at very low clearance prices. — Box 122, Offices of the Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

£20 BUYS WORLD'S BEST WELDING PLANT. Latest Designs, Automatic Action.—Write for illustrations, Sirius Welding Works, Imperial Street, Bromley, London, E.3.

Hornsby Stockport 60-h.p. Gas Engine and Suction Plant. (Two Sets available.)

76 B.H.P. Dudbridge Suction Gas Engine and Plant, new 1917.

6-in. Roots Blower; 2 Sirocco 8-in. Fans.

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HARRY H. GARDAM & CO., LIMITED, STAINES.

MISCELLANEOUS.

WANTED to purchase, well-established Iron Foundry, or would invest up to £2,000 in well-established Engineering works, and take over Foundry management. Practical moulder and pattern-maker. Age 40.—Box 106, Offices of the Foundry Trade Journal, 5, Duke Street, Adelphi, London, W.C.2.

THE best equipped foundry in London for sale outright, or would form a limited company.—Write, Box 112, Offices of the Foundry Trade Journal, 5, Duke Street, Adelphi, London, W.C.2.

FORGINGS up to 4 inch square and general castings up to 5 cwt. Our prices are low and competitive. Ask us to quote you. Telephone: Avenue 9686.—Herts Foundry & Forgings, Limited, 172, Bishopsgate, E.C.

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